A fungus, a gnat and an orchid — the Helmet Orchid's strategy of deception

Fig. 1. Fringed Helmet Orchid *Corybas fimbriatus*. Photo by Pat Grey.

Cam Beardsell, Parks Victoria Ranger and orchidologist, observed the game of deception played each winter by Helmet Orchids in the eastern Conservation Zone of the Yarra Valley Parks. Out Warrandyte way, in the Red Box woodland, there exists a curious *ménage à trois* between a fungus, a fungus gnat and an orchid (or several). All grow together on the river terraces in moist, shady areas.

The fungus is *Dermocybe clelandii* (previously *Cortinarius subcinnamoneus,* identified by JH Willis, pers. comm. 1983)(see front cover). It has a dark brown cap (diameter to 65 mm) with a pale margin, mustard-yellow gills, which become rusty-brown with maturing spores, and a yellowish-brown, fibrous stem (length to 75 mm). The cobwebby veil (cortina) covering the young gills is a pale yellow. The dry cap and stem place it in the *Dermocybe* group of the Cortinarius family.

Fungus Gnats (*Mycomya sp.*) belong to the family Mycetophilidae. They are small, mosquito-like flies with a characteristic humped thorax and long slender legs. The larvae are long and worm-like with soft whitish bodies. Female Fungus Gnats normally lay their eggs under the cap of *Dermocybe clelandii*, in amongst the gills. When the larvae hatch, they eat their way through the mushroom cap, then drop to the ground to pupate.

However, in her search for an egg-laying site, the female Fungus Gnat is tricked into pollinating several species of Helmet Orchid (Genus *Corybas*) (Fig. 1). Helmet Orchids grow near the ground and have one green leaf and a maroon flower. The Helmet Orchid mimics the shape and scent of *Dermocybe clelandii,* and so tricks the female gnat, which enters underneath the 'helmet' in search of a site to lay her eggs. Instead, she is dusted with pollen before realising her mistake and moving on. The Fungus Gnat needs to be tricked twice for the strategy to work so she must visit a second helmet orchid to deposit the pollen.

But that is not the end of the story; in contrast, the male Fungus Gnat is tricked into pollinating species of Gnat Orchids *Acianthus* spp. and Greenhoods *Pterostylis* spp. The attraction here is sexual: the pheromones emitted, and the shape of the orchid labellum mimic female Fungus Gnats. The male gnat tries to 'mate' with the orchid. Instead, it picks up pollen which is then carried to other Gnat Orchids or Greenhoods for their pollination. In Greenhoods, when the male Fungus Gnat, its dorsal side towards the flower, tries to copulate with the labellum, it triggers the labellum to spring back and trap the insect with its front end towards the top of the hood and against the column. This is where the stigma and anthers with the pollinia are positioned and pollen is deposited on the gnat.

This relationship holds an evolutionary puzzle. The Fungus Gnat family is Gondwanan, and must date back before the break up of the ancient southern super-continent about 50 million years ago. On the other hand, the ancestors of the Helmet Orchid are much later colonisers of Australia, entering when the Australian

tectonic plate neared the islands to the north about 20 million years ago. Some Helmet Orchid relatives are epiphytes on the branches of tropical trees. How did our Helmet Orchids' exploitation of the Fungus Gnat evolve?

This is just one example of how very complex ecosystems are. The threat to these and many other native orchids is obvious. If their pollinators are wiped out, the orchids are doomed. In this case, the Helmet Orchids, Gnat Orchids and Greenhoods depend on the survival of the Fungus Gnat, which depends on the survival of the mushroom, *Dermocybe clelandii*. In turn, this mushroom, by its mycorrhizal association, ensures the health of the eucalypts ... and so on.

Acknowledgements

Thanks to Cam Beardsell for this wonderful tale.

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Springtail eats slime mould!

On 5 July 2009, the Fungi Group of the Field Naturalists Club of Victoria (FNCV) made a fascinating discovery while foraying on the Lerderderg Heritage River Trail from the Jack Cann Reserve, in the Wombat State Forest, near Blackwood, Victoria. (37°28'35.4"S 144°17'13.2"E; I can give the location with confidence because it was right next to a rare 'toothpick' fungus that we were recording and we took a GPS reading of that).

The trail passes through dry box and stringybark heathy woodland and on the side of the track we found a bright yellow slime mould (Myxomycete) on a patch of leafy liverwort. This was not especially unusual in itself, but I am interested in slime moulds and was keen to record it. The specimen was still transforming from the plasmodial stage, but the very weak strand-like stalks and pendant sporangia suggested it was *Badhamia* sp. However, while photographing the slime mould, I noticed that some of the sporangia had been disturbed and seemed to be reverting back to plasmodial slime— something they easily do when physically disturbed at this stage of their development. Upon closer inspection of my photos, I was surprised, and delighted, to see the cause of this disturbance—a tiny creature was feasting on the slime mould!

This stunningly beautiful little beastie (it was only about 3–4 mm long) (Fig. 1) had the most remarkable colours and features. It had a purple body with two rows of pink processes down each flank (the outer ones were quite long). I had never seen anything like it before, so I sent an image to Ian Endersby who suspected it was a type of springtail and forwarded it on to Penny Greenslade (a world-renowned expert on the taxonomy and ecology of Collembola). She confirmed that it was indeed a springtail—an uchid Collembola of the genus *Acanthanura* (subfamily Uchidanurinae). The species of this subfamily are the largest and most spectacular of the springtails, and unlike most springtails, lack a jumping organ. Greenslade co-authored an article in *The Victorian Naturalist* (Greenslade *et al.* 2002), describing log-inhabiting Uchidanurinae. The article recorded two observations of these creatures feeding on the plasmodial stage of slime moulds in Victoria and Tasmania, and suggested that this may be more common than previously thought. She suggested that their specialised mouthparts indicate that they have a preference for, or even feed exclusively on, slime moulds.

Penny was quite excited by this find and pointed out that these creatures are quite rare